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(54) Take-up reel assembly

(57) A take-up reel assembly (14) comprises a core (138) for receiving a web or other elongate flexible member which is to be indexed by a constant amount over a linear path upstream of the assembly in an associated apparatus irrespective of the amount of web wound on the core, an input drive member (108) co-axial with the core, a first uni-directional clutch (137) (not shown) within the core and operative to drive the core in one sense only through a bush (134) (not shown) having abutment means (149) (not shown) inwardly of the clutch and a second uni-directional clutch (157) (not shown) within the core and operative in the said one sense only and surrounded by a second bush (148) (not shown) incorporating abutment means engageable with the abutment means of the first bush, and resilient means (146) (not shown) operative in each cycle of motion of the assembly to store a quantity of energy directly dependent upon the angular motion appropriate to the amount of web wound on the core required to provide said constant indexed motion, the energy being supplied to the resilient means through the abutment means of the second bush and the core being driven to index the web by the resilient means through the first bush and abutment means. The clutches may be Torrington clutches.

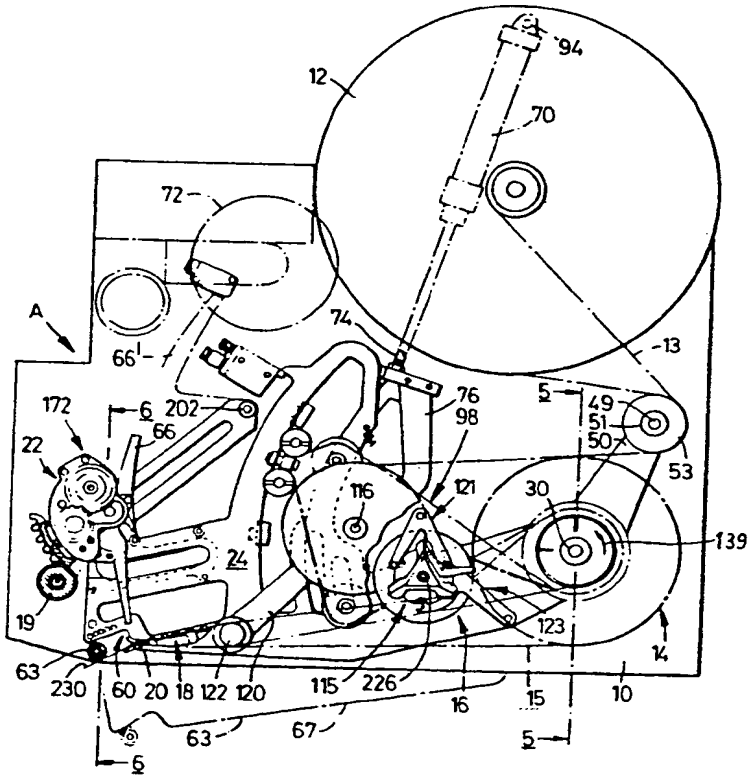

FIG. 1.

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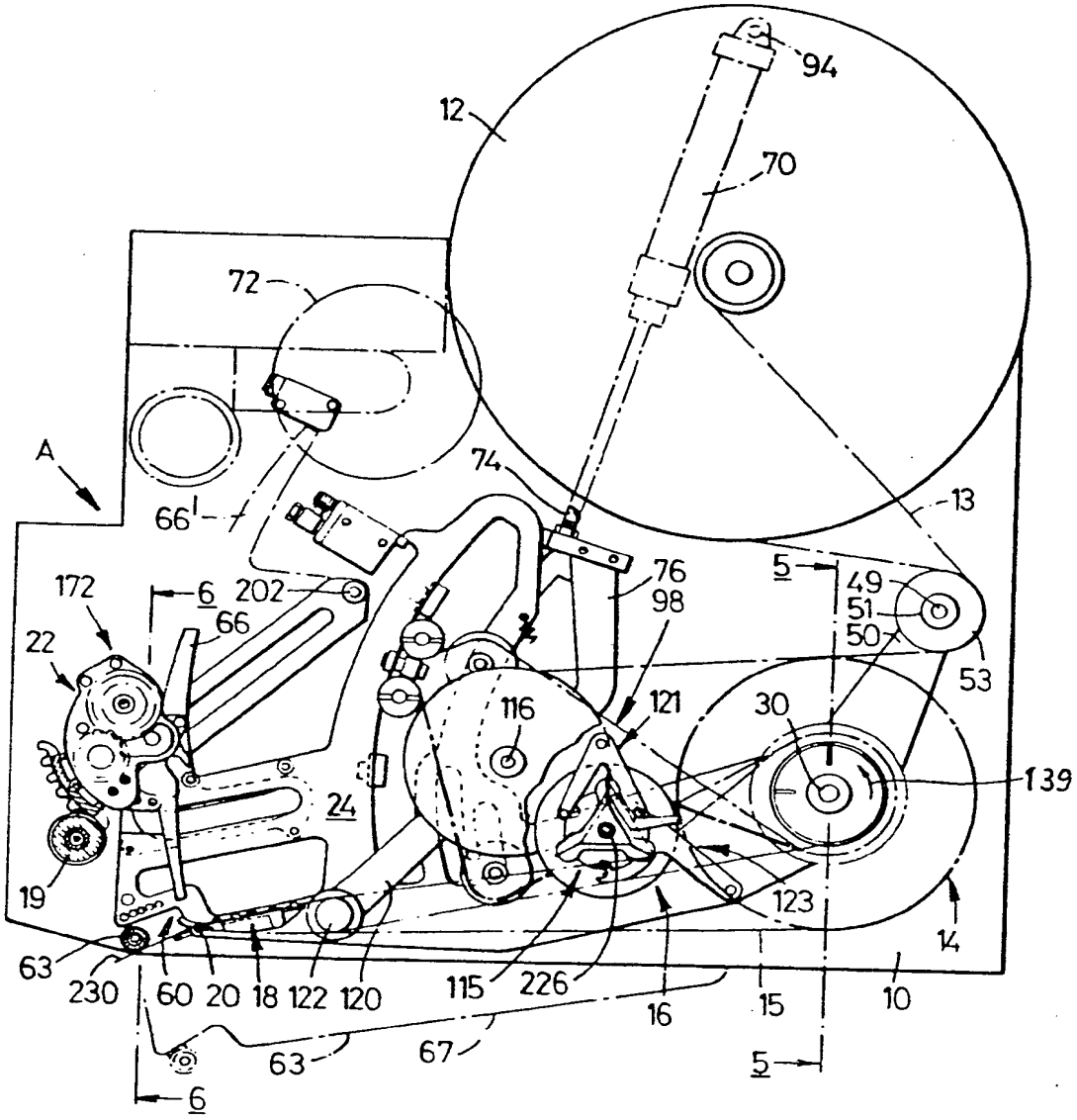
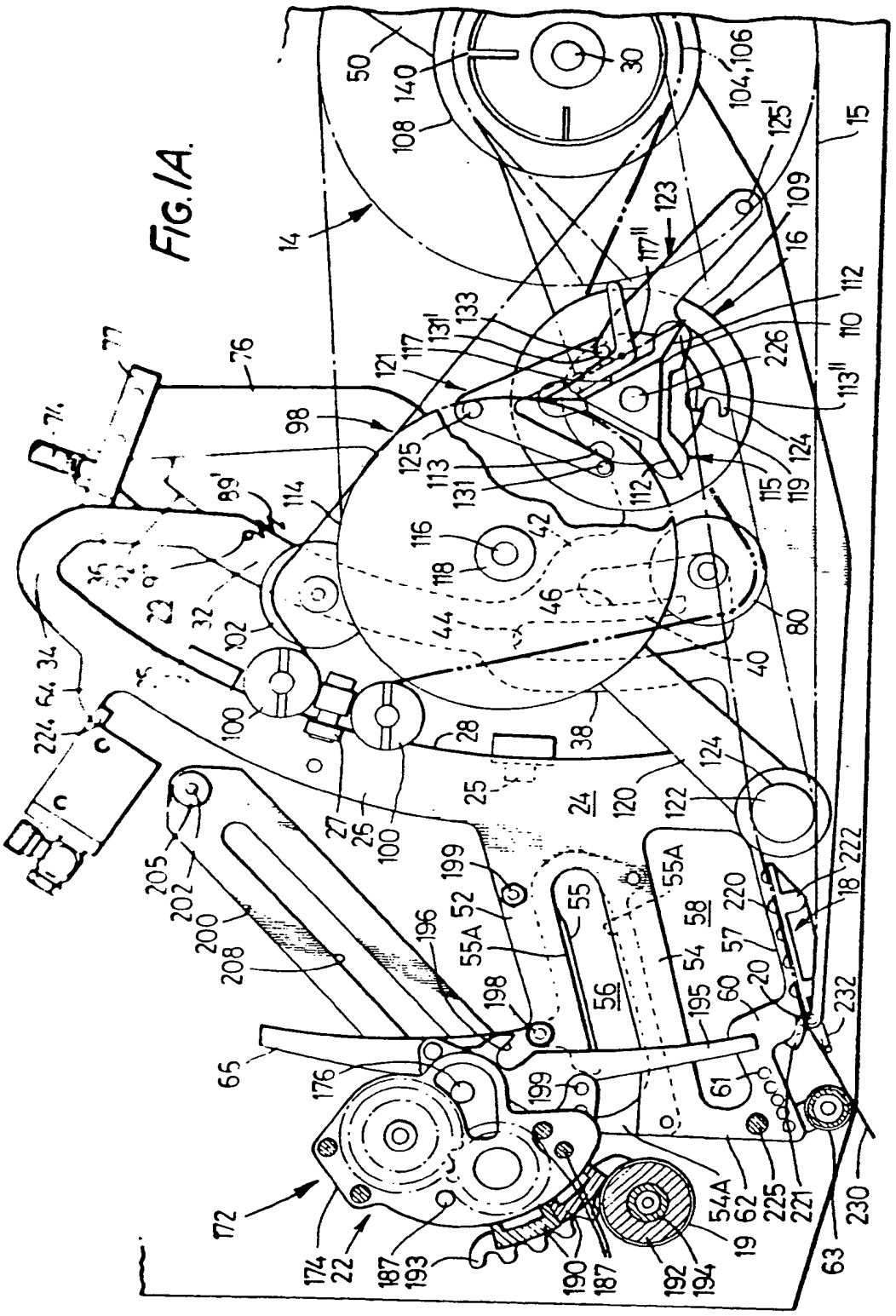

94
12
70
72
A
74
66'
13
76
98
5
49
51
50
53
172
6
202
66
22
116
121
30
139
24
19
123
14
63
230
60
20
18
122
120
115
226
16
15
10
63
67
5
6

FIG. 1.

FIG. 1A.


50
140
108
30
104,106
125'
15
14
123
117''
16
109
112
133
131'
117
121
226
110
113''
76
77
74
98
125
113
131
112
115
119
124
89'
114
116
118
42
46
44
32
102
100
80
40
38
28
25
24
120
122
27
26
100
205
202
200
208
199
52
55A
55
58
220
222
18
196
198
56
54
57
20
60
195
232
65
176
61
172
174
22
187
193
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54A
62
225
221
19
63
230
224
64
34

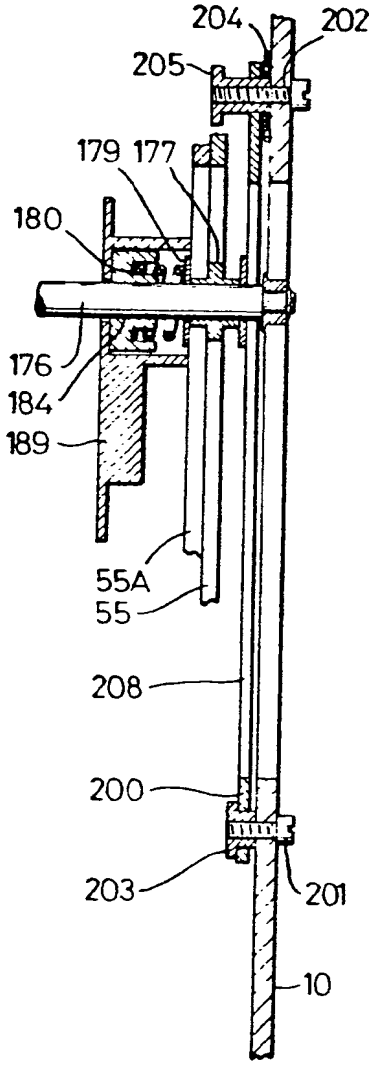
204
202
205
179
177
180
176
184
189
55A
55
208
200
203
201
10

FIG. 2A.

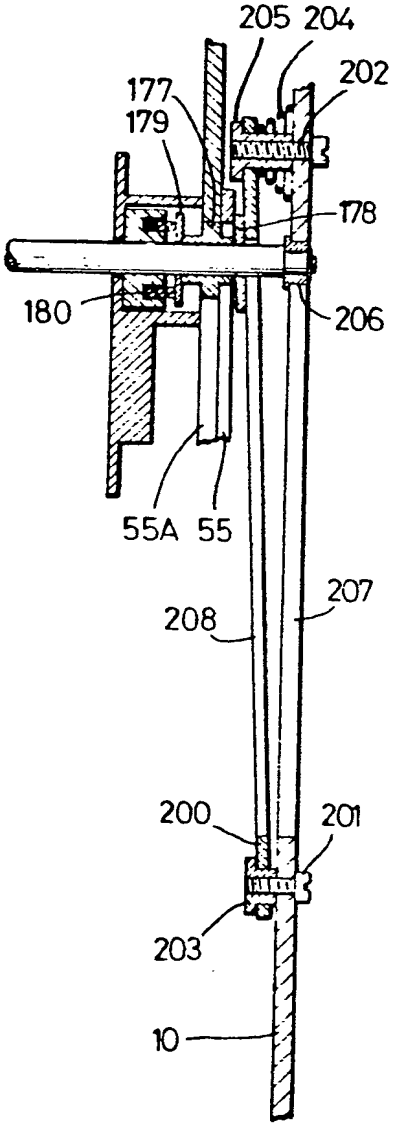
205
204
202
177
179
178
180
206
55A
55
207
208
200
201
203
10

FIG. 2.

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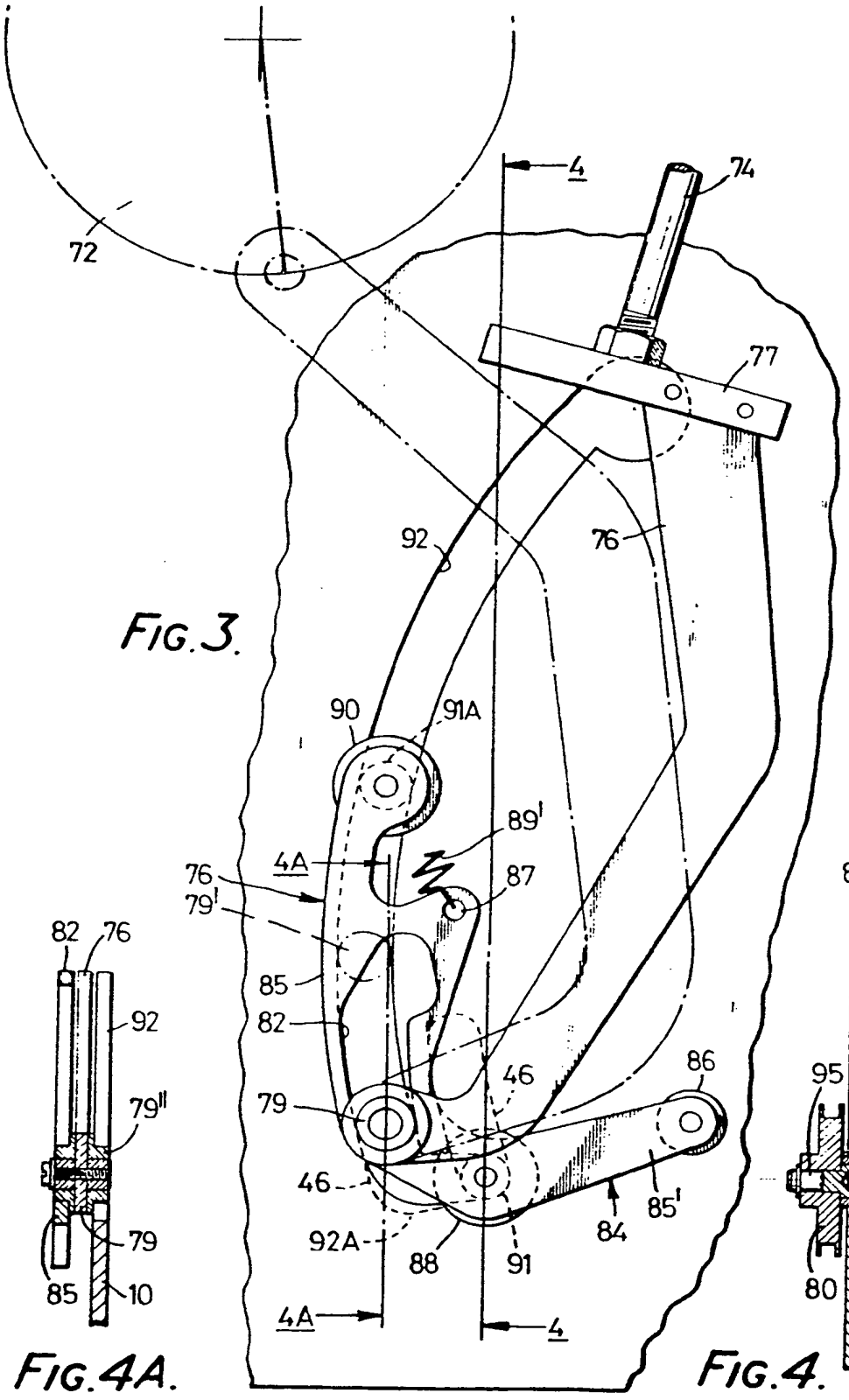

FIG. 3.

FIG. 4A.

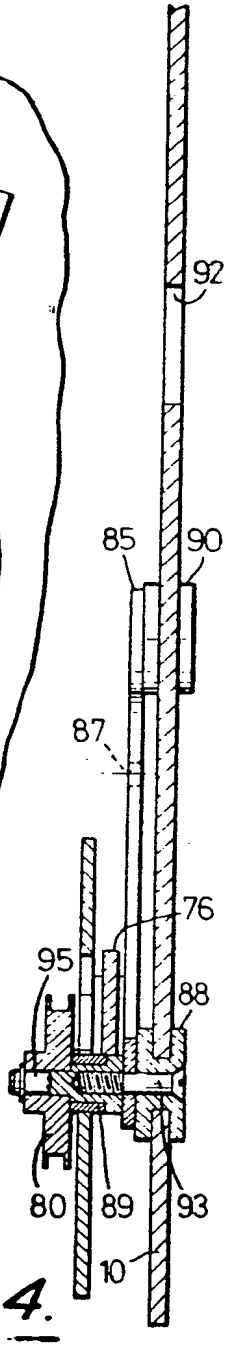

FIG. 4.

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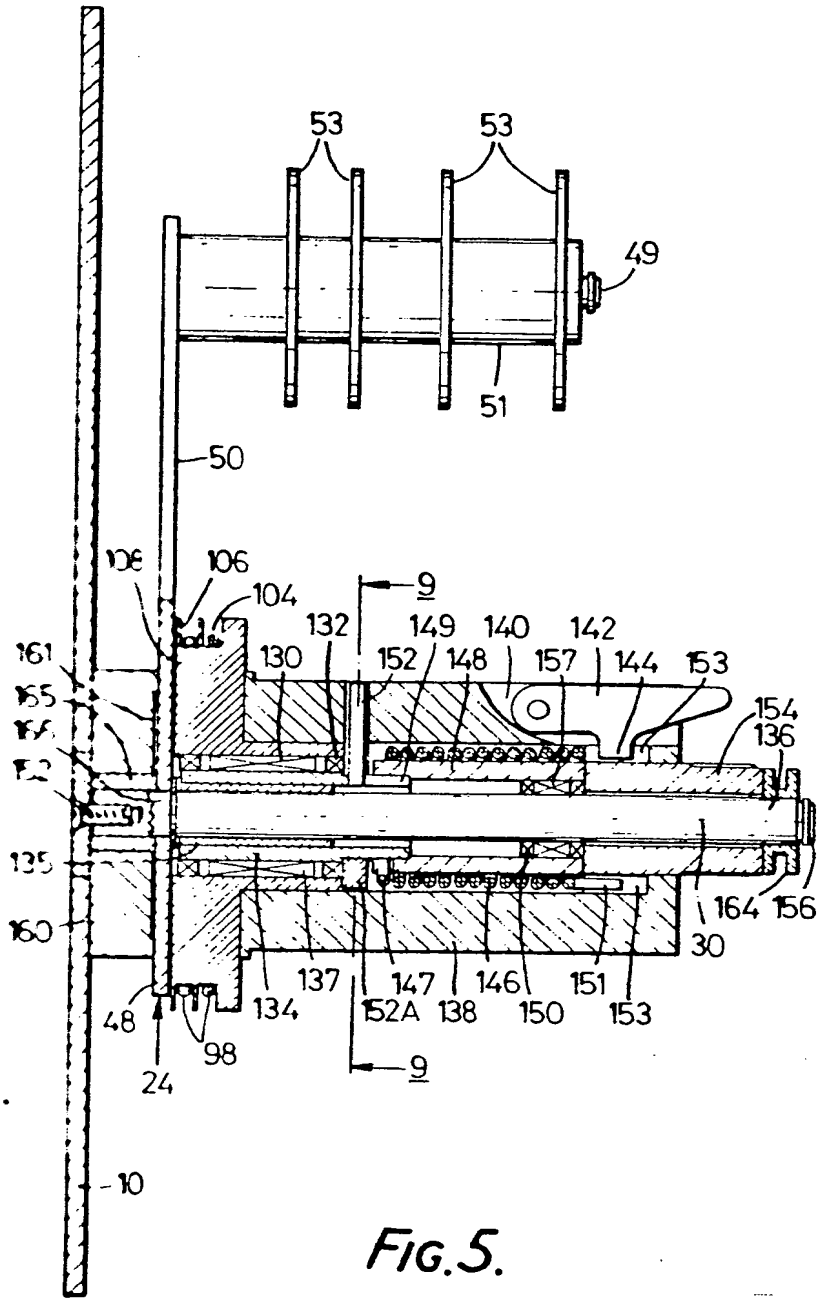
53
53
49
51
50
108
106
104
9
132
149
140
142
161
130
152
148
157
144
153
154
136
135
160
164
156
30
137
147
146
151
48
134
152A
138
150
153
98
24
9
10

FIG. 5.

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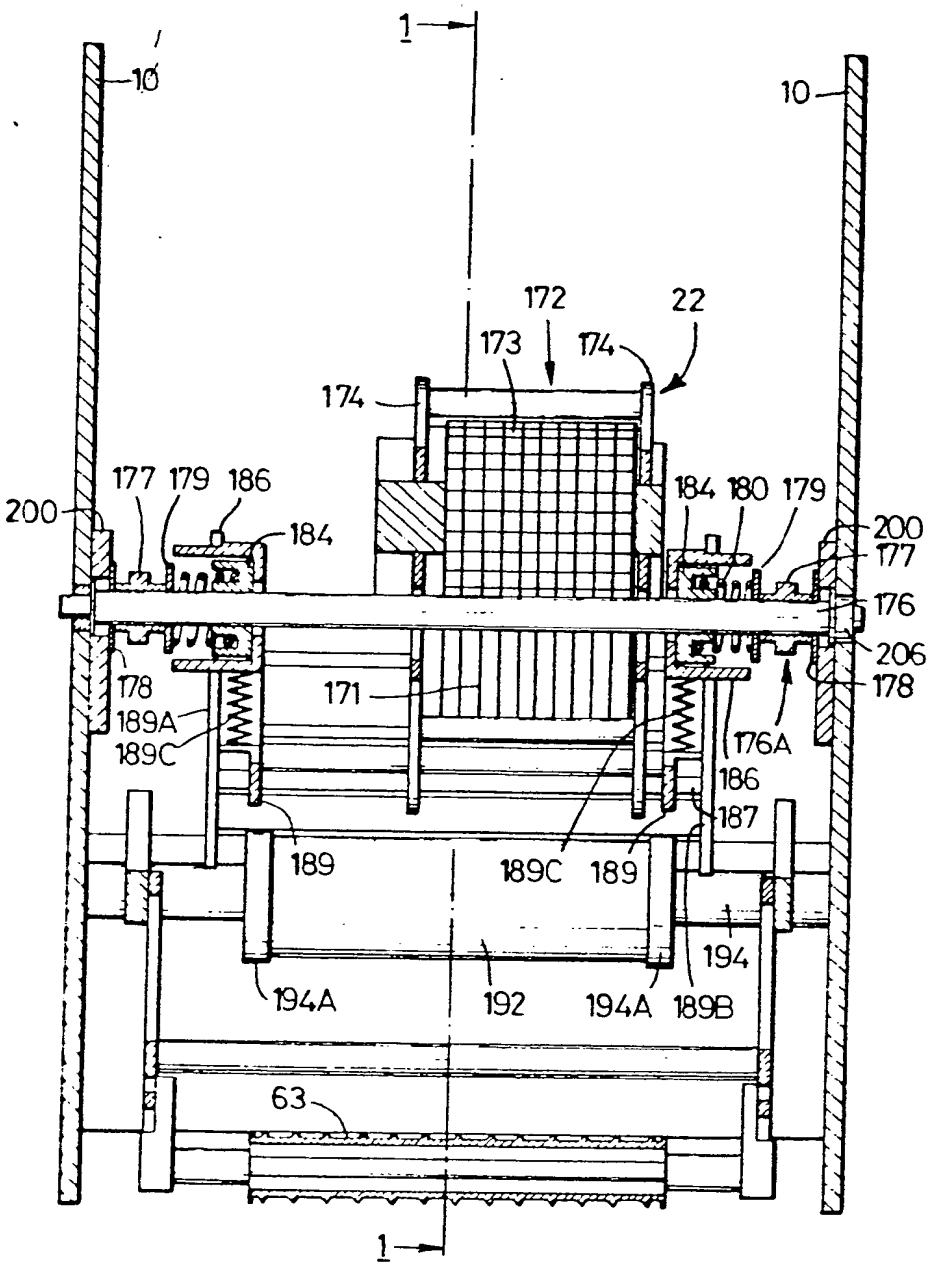


FIG. 6.

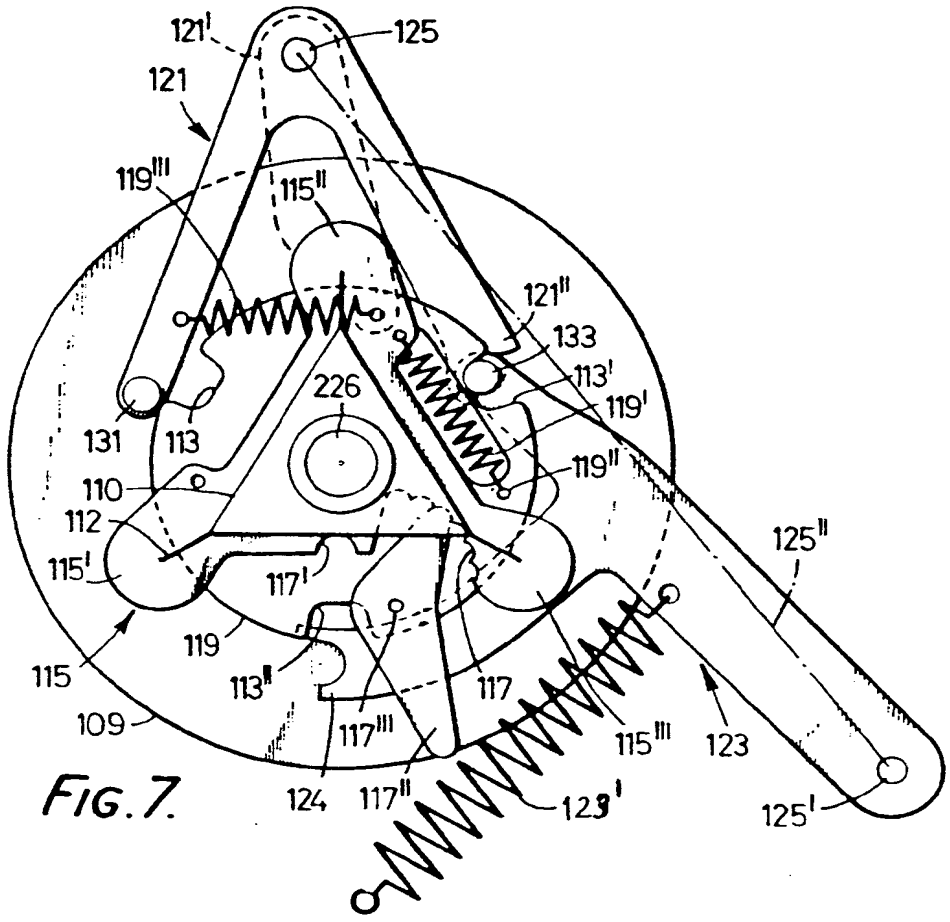


FIG. 7.

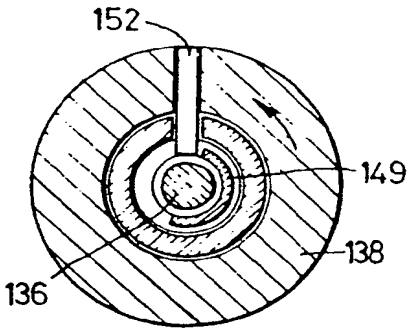


FIG. 9.

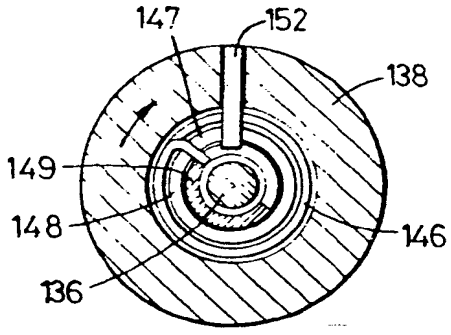
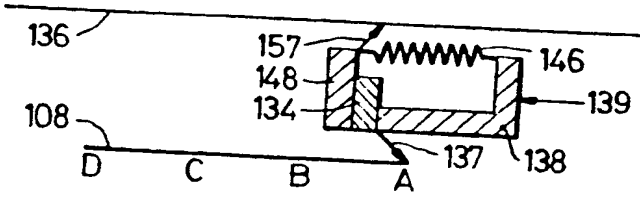


FIG. 9A.



0 LABEL

FIG. 8A.

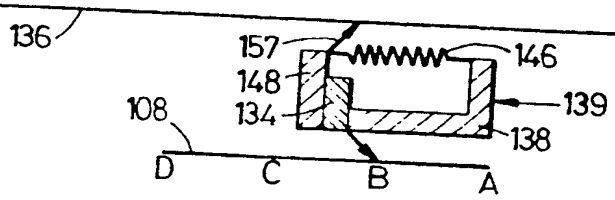
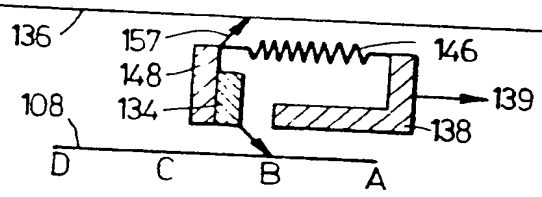
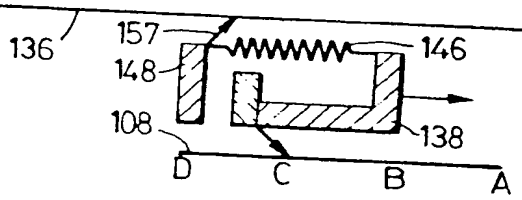


FIG. 8B.



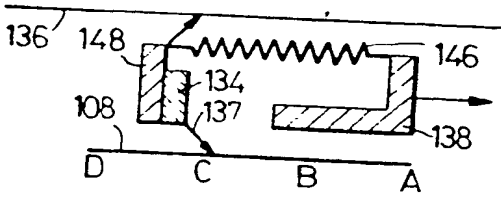
3 LONG LABEL

FIG. 8C.



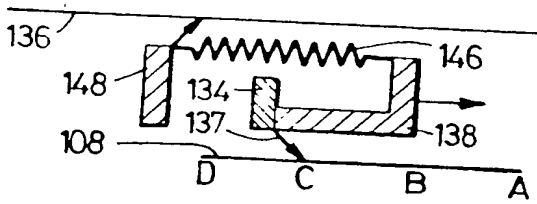
3 LABEL

FIG. 8D.



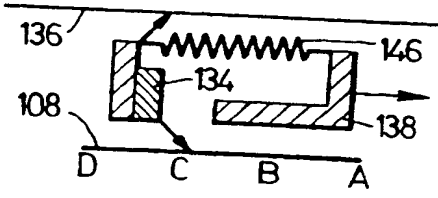
3+1 LONG LABELS

FIG. 8E.



3+1

FIG. 8F.



3+1+2 LONG LABELS

FIG. 8G.

SPECIFICATION

Web drive system

This invention relates to a take-up reel assembly which forms a drive for a web, for example of spent backing strip of a label web comprising initially the backing strip and self-adhesive labels.

It is conventional practice to draw a web of backing strip and self-adhesive labels through a label printer and applicator by means of a take-up reel assembly by which the web is fed through the machine. As it will be understood the length of each label on a given web will be constant but, at the take-up reel the amount of angular motion corresponding to that constant length will vary in indirect dependence upon the amount of spent backing web on the reel Thus, initially when the effective diameter of the take-up reel is small, the amount of angular motion necessary for a winding on given label length is large. Correspondingly, when the take-up reel has a large diameter the angular motion is small. With this background in mind it is clearly necessary that the angular motion shall be exactly controlled throughout the printing and dispensing of a given web of labels and the objective of the present invention is to provide a take-up reel assembly incorporating a drive device which meets these practice requirements in a simple and effective manner

According to the present invention there is provided a take-up reel assembly comprising a core for receiving a web or other elongate flexible member which is to be indexed by a constant amount over a linear path upstream of the assembly in an associated apparatus irrespective of the amount of web wound on the core, an input drive member co-axial with the core, a first uni-directional clutch within the core and operative to drive the core in one sense only through a bush having abutment means inwardly of the clutch, and a second uni-directional clutch within the core and operative in the said one sense only and surrounded by a second bush incorporating abutment means engageable with the abutment means of the first bush, and resilient means operativein each cycle of motion of the assembly to store a quantity of energy directly dependent upon the angular motion appropriate to the amount of web wound on the core required to provide said constant indexed motion, the energy being supplied to the resilient means through the abutment means of the second bush and the core being driven to index the web by the resilient means through the first bush and abutment means.

A label printer and applicator embodying the invention will now be described, by way of example only, with reference to the accompanying diagrammatic drawings, in which:

Figure 1 is a side elevation (certain parts being a section on line 1-1 of Figure 6) showing certain components of a label printer and applicator in accordance with the invention;

Figure 2 is a scrap view in the direction of the arrow A of Figure 1;

Figure 2A is a scrap view of the parts shown in Figure 2 but with the parts in a different operative configuration;

Figure 3 is a scrap view illustrating a part of the power-input mechanism of the applicator;

Figure 4 is a section on the line 4-4 of Figure 3;

Figure 4A is a section on the line 4A-4A of Figure 3;

Figure 5 is a section on the line 5-5 of Figure 1;

Figure 6 is a section on the line 6-6 of Figure 1;

Figure 7 is a scrap view, to an enlarged scale, of a detail illustrated in Figure 1;

Figures 8A to 8G are further diagrams illustrating the manner of operation of the take-up reel mounting;

Figure 9 is a cross-section on line 9-9 of Figure 5; and

Figure 9A is a cross-section on line 9-9 of Figure 5 but with the parts in a different configuration.

Referring now to the drawings and in particular Figure 1 the applicator comprises essentially a base plate 10 which serves (together with a further plate 11 -Figure 6) to mount the various components which broadly are as follows. A mounting 12 for a reel of self-adhesive labels carried on a backing web 13 of silicone-treated paper, a take-up reel and drive mounting assembly 14 for receiving spent backing web 15 (chain lines), a registration device 16 which ensures that individual labels are correctly presented to a print station 18, a dispense edge 20 immediately downstream of the print station at which printed labels are peeled from the backing and located ready for application to an article, and a print head assembly 22 which is operative to print on the upstroke of a control plate 24 i.e. clockwise (as shown) which pivots on an axis 30.

All the working parts enumerated above are directly associated with and are controlled by the actuating and control plate 24 which includes the following individual parts. An arcuate limb 26 includes an arcuate edge 28 and this edge is centered on the axis 30 of rotation of the take-up reel mounting assembly 14. The limb 26 is supported by ball or roller bearings 25 lying beneath it and one ball or roller bearing 27 lying above it. The edge 28 forms one boundary of a generally arcuate slot 29, the other boundary being defined by a limb 32 which is connected to the limb 26 by an arcuate tip portion 34 and a portion 36 inclined to the limbs 26 and 32. The lower portion of the limb 32 (as shown) is divided into three parts 38, 40, 42 (the latter two being shown in broken lines) and these parts

together define two further, but substantially smaller, arcuate slots 44, 46 having their axes coincident with the axis 30, the two slots 44, 46 being joined at their lower ends so that they combine to form a U-shaped slot with unequal, arcuate, portions.

To the right of the limb portion 42 the control plate 24 extends to a boss 48 (Fig.5) having a centre coincident with the axis 30 and extending finally to an arm 50 also shown in Figure 5. The free end portion of the arm 50 carries on a spindle 49 a freely rotatable bush 51 with four discs 53 which serve together as a web path roller.

As is apparent from Figure 5, the axis 30 represents the centre of the take-up reel assembly 14 to be described in detail hereinafter, but it is to be noted that this axis is fixed relative to the base plate 10, and constitutes the pivot axis of the control plate 24 and associated parts mounted thereon.

The main actuating and control plate 24 also has extending from the limb 26, portions 52, 54 which together define a slot 56, the limb 54 forming a boundary of an irregular opening 58 (for weight reduction) which is also bounded by a downwards, (as illustrated) prolongation of the limb 26, a portion 57 of the control plate extending to the dispense edge 20, and then by a cranked portion 60 having a plurality of apertures 61 to a portion 62 which terminates at that end of the portion 54 which is remote from limb 26. The slot defined by portions 52, 54 is associated with linear cams 55,55A secured by small nuts and bolts to the portions 52,54. The cam 55A is obscured, in Figure 1, by the upper edge, as shown, of the portion 54. The dispense edge takes the form of a freely rotatable pin 20. The cranked portion 60 carries at its junction with the vertical (as shown) portion 62, an application roller 63 with annular ribs (see Fig.6). The apertures 61 provide for different locations of the application roller 63.

The limb 26 also has a projection 64 towards its upper end which serves a stop control function to be described hereinafter.

The portion 52 at the end remote from the limb 26 has an elongate upstanding part 66 for print head control and the upper limit of arcuate movement of the control plate 24 as a whole about the axis 30 is indicated in chain lines 66' and the lowermost position indicated by chain lines 67. At the lower position 67 the labels which have been printed during an upstroke are applied to an article (not shown) to be labelled.

The parts associated with the control plate 24 will now be described. The necessary power input is achieved either by a pneumatic cylinder 70 (chain lines) lying mainly behind the fresh web mounting 12 (Figure 1) or alternatively by a crank (not shown) driven by an electric motor, the path of the crank being illustrated in chain lines 72 to the left of the fresh web mounting 12. The upper end of cylinder 70 is pivoted at 94 to the base plate 10. Details of the motor and crank drive are not given since they are entirely conventional. The pneumatic actuator 70 has its piston rod 74 permanently connected to the upper end of a cranked link 76 through the intermediary of a low-friction plastics bar 77 slidable on the plate 10 which link carries at its lower end a stepped roller 79 (Figs. 3 & 4A), a smaller diameter part 79' (indicated at an alternative location in broken lines in Figure 3) of which is movable in a slot 82 of a link 84 which serves to transmit motion of the pneumatic actuator to the control plate 24. A further smaller diameter part 79" of the roller 79 moves in an arcuate slot 92 in the plate 10. The link 84 is of somewhat complex shape but basically has two arms extending approximately at right angles to one another, one arm 85 being generally arcuate and including the slot 82, the other arm 85' being generally straight. The arm 85 is biassed by a helical tension spring 89', attached at a hole 87 and at pin 97 (Fig.1) on the limb 32 of the control plate 24 and the arm is slidable on the base plate 10 with the aid of three plastics sliders 86, 88, 90, the sliders 88 and 90 being concentric with further, smaller, diameter sliders 91, 91A which are guided in the arcuate track 92 formed in the base plate 10. The track 92 in the base plate 10 has its centre on axis 30 and has a generally circular enlargement at its upper end (as shown) which is used only for assembly purposes and an extension 92A at its lower end (as shown) receives slider 91 in the position as illustrated. The slider 88 is also concentric with a pulley 80 which lies above the control plate 24 as illustrated in Figure 1 and 4.

As is apparent in Figure 4, the slider 88 is retained in the slot of the base plate 10 by a screw 93 which engages in a stepped spindle 95 on which a roller 89 and the pulley 80 are mounted for free rotation.

The pneumatic cylinder 70 is controlled by appropriate control devices (not shown) but the operational effect of the cylinder and parts directly associated therewith will be described hereinafter.

The motion of the piston rod 74 transmitted to the link 76 is imparted to the control plate 24 which in turn actuates both the take-up reel 14 and the registration device 16. Both functions are effected by a non-extensible cable 98 (chain lines) the free ends of which are anchored by anchor pulleys 100, both of which are mounted fixedly on the base plate 10. Because both ends of the cable are fixed it can exert a "push-pull" function so that the motions of the cable are dictated by guide pulley 80, already referred to, and pulley 102 which is rotatably mounted on the limb 32 of the control plate. The cable 98 also engages in pulley grooves 104, 106 (Fig.1 and 5) of a

pulley member 108 concentric with the axis 30 and which will be described in relation to the take-up reel assembly hereinafter. As will be apparent from Figure 1, starting from the upper anchor pulley 100, the cable passes into the groove 104 of the member 108, around a major proportion of a pulley 109 concentric with the registration device 16, then into the groove 106 of the member 108 (closer to the base plate 10), thence around the pulley 80 and finally to the lower of the two fixed pulleys 100. To assist understanding the portion of the cable 98 extending from the upper pulley 100 to the groove 104 and from that groove to the pulley 109 is shown in bold single chain line. That portion which extends from pulley 109 to pulley groove 106 and thence to pulley 80 and lower pulley 100 is shown in bold double chain line.

The registration device 16 comprises a central boss 110 of triangular section with blades 112 at each apex of the triangle so that the blade edges themselves effectively define a sharp-cornered triangle. The boss 110 is mounted for rotation on a spindle 226 carried by the control plate 24. The transverse edges of successive labels are slightly spaced along the length of the carrier or backing web and these discontinuities are engaged by the tip edges of the blades 112. As will be apparent from Figure 1, in the registration position illustrated, two of the blades are about to co-operate with four disc members 114 (only one shown) freely rotatably mounted on a spindle 116 and bush 118. When both of these blades are in contact with the discs 114, stability is provided after indexing of one label of the web, the label 230 being shown at the finishing stage of dispensing. The spindle 116 is itself mounted on an arm 120 pivotal about an axis 122 on a pivot 124 which also acts as a guide roller for the label web. The arm 120 is lightly biassed in the clockwise sense (as shown) by a helical tension spring (not shown) extending between the free end of the arm and a locating peg on the control plate 24 disposed beneath the registration device 16. The use of discs 114 instead of a drum reduces frictional action on the registration mechanism whilst at the same time ensuring lightness, precision of location of the triangular member at each one of its three predetermined angular locations and action as a path roller for the web to the triangle registration device.

Forming a part of the registration device 16 is a locking mechanism which serves to prevent rotation of the indexing registration device 16 except when positively dictated by other parts of the mechanism. This locking mechanism includes a disc 119 with three recesses 113,113' and 113" one of which at any angular location receives one of the pins 131,133 of two levers 121,123 described in detail with reference to Figure 7. This arrangement ensures that at all times the label web is tensioned and under full control even if the cycle of operation is interrupted for some reason.

As will be apparent from Figure 1, the triangle 110 and blades 112 of the registration device can basically take up two different configurations relative to the spindle 116 and the discs 114. In one configuration, the discs 114 "nest" at parts of their peripheries between two of the blades 112, while in another configuration the tip of one blade 112 slides over the peripheries of the discs 114 and to enable this movement the discs 114 move in an anticlockwise sense against the bias of the tension spring acting on the arm 120.

Referring to Figure 1 and 7, the locking mechanism includes the two pivotal levers 121, 123, one of which 121 is pivotally mounted on a pin 125 carried by an arm 121' (broken lines in Fig. 7) rigid, at its radially inner end with the underside of disc 109 by a pin (not shown). The other lever 123 is pivoted on a pin 125' mounted on the control plate 24. The lever 121 has two arms, one of which carries the pin 131 at its free end and the other arm is bifurcated at its free end 121" to form a notch which can engage the pin 133. The lever 123 has three arms, one carrying the pin 133 at its free end, another arm receives the pivot pin 125' and the third arm is arcuate and has a bifurcated portion (124) at its free end. The bifurcation 124 is arranged to engage the pin 131 when the registration device is being indexed.

The locking mechanism further includes a three lobed member 115, the lobes 115', 115" and 115"' of which are located angularly in the same orientation as the apices of the triangle 110 in the configuration as illustrated. The edges lying respectively between lobes 115' and 115" and between 115" and 115"' are rectilinear, whereas the edge between lobes 115"' and 115 includes a snail cam 117 and a semi-circular recess 117'. The six notches of the cam enable variations in the dispensing of the labels. The semi-circular recess 117' serves as an indicator, coupled with appropriate written instructions, to enable adjustment of the operation of the snail cam 117.

In the configuration as illustrated in Figure 7 the snail cam 117 is engaged by the tip of one arm of a pivotal two-armed lever 117". The pivot pin 117"' of the lever is mounted on the disc 119 and adjustment of the lever to engage one of the other notches effects a desired change in the relative angular relationships within the range ±6o. The lobed member 115 including the snail cam ~~is b~~biased in a clockwise sense by a helical tension spring 119' acting between the lobe 115" and a pin 119" carried by the pulley 109. The spring passes through disc 119 at a slot therein. A further tension spring 119"' acts between the

arm of the lever 121 carrying the pin 131 and a securing pin on the upper surface of the lobed member 115. The spring 119"' is anchored to the same screw (not shown) as that which secures the arm 121' to the pulley 109. The springs 119' and 119"' are omitted from Figure 1 to avoid overcrowding that Figure.

It will be seen from Figure 7 that two arms of the levers 121 and 123 are in a slightly overcentre relationship to the pin 133 carried by the same arm of lever 123. This is clearly indicated by a line 125" joining the pivot pins 125 and 125'. A spring 123' anchored at one end to the control plate 24 biases the lever 123 in the anti-clockwise sense as shown in Figure 7. It will be noted that the radius of the pin 133 is less than the radius of the recess in the bifurcated end 121" of the lever 121.

The take-up reel core mounting 14 will now be described, the only part of which has already been mentioned being the pulley member 108 having peripheral grooves 104, 106. The member 108 oscillates clockwise and anti-clockwise over a limited but constant, angular range in a manner corresponding to that of the registration device. This member 108 comprises a disc with a central bush 130 which is rotatably mounted by bearings 132 on an inner bush 134 mounted on a spindle 136 fixed to the control plate 24, plain bearings 135 being interposed between the bush 134 and the spindle 136. The spindle is fixed to the plate 24 and cannot either rotate or move axially relative thereto. The spindle 136 is, however, rotatable relative to the base plate 10. The boss 48 and the base plate 10 are spaced by a "Delrin" (R.T.M.) acetyl resin disc 160 which has internally a steel bush 165 having an axial length slightly greater (0.1 mil) than the thickness of the spacer 160. The bush is secured to base plate 10 by screws (not shown). This combination forms an effective thrust and journal bearing. The spindle 136 is clamped to the control plate boss 48 by a circlip 161 engaged in a groove 166 of the spindle.

A Torrington, one-way, clutch 137 also lies between the bush 130 and the inner bush 134. A cylindrical member or core 138 is mounted externally on the bush 130 and extends axially of the spindle 136 beyond the bush 134; at the outer end portion, the core 138 has a radial slot 140 which receives a pivotal locking lever 142 having a projection 144. The projection 144 can engage in any one of eight slots 153 arrayed around the outer periphery of an externally knurled cap or end member 154.

A helical spring 146 lies within that portion of the cylindrical core 138 lying axially beyond the bush 134 and radially outwardly of a further bush or drive collar 148. The latter is again concentric with the spindle 136 and is mounted thereon by roller bearings 150. That end portion of the bush 134 remote from the boss 48 is cut away to form a semi-annular dog 149 (Figures 9 and 9A) and one axially-extending face of the dog is engageable with one end portion (or tail) of the spring 146, the other end portion or tail 151 being anchored in a selected one of the slots of the cap 154. The bush or drive collar 148 also has slot (Fig. 9A) which anchors the said one end portion of the spring 146. A second Torrington, one-way clutch 157 is located between the bush 148 and the spindle 136 and is operative to drive in the same sense. The bush 134 which is driven by the first Torrington clutch 137 serves to "wind up" the spring 146 through the dog 149, the amount of winding being dependant upon the angular motion of the member 138 during the immediately preceding cycle. A drive pin 152 passing through the core 138 and radially inwardly thereof, acts, with some lost motion, when the clutch 137 drives in the wind-up sense to rotate the core anticlockwise as shown in Figs. 1 and 9. There is free motion between the pin 152 and the dog 149. A low friction collar 152A limits the actual engagement of the dog 149 of the bush 134 and the bush or drive collar 148, the dog 149 being received in a stepped bore of the drive collar 148.

At the outer end of the spindle 136, the cap 154 has a circlip (not shown) engaged in a groove 156 of the spindle 136 in order to hold the assembly together. Axially inwardly of the groove 156, a spacer collar 164 is provided which receives one end of a brace (not shown) which also serves to brace the free end of the registration device spindle 226.

The print head assembly 22 is mounted between the two plates 10,11 and includes a generally conventional dialset mechanism including a number of print bands 171 and read-out wheels 173, the whole dialset being indicated generally by the reference 172. The dialset mechanism is mounted between a pair of frame members 174 and a spindle 176 passes between the two plates 10,11 and through a passage in the dialset. The spindle 176 carries parts which ensure that the print head assembly is resiliently mounted for limited motion radially relatively to the axis of the spindle 176 to accommodate clearances and any uneveness so that printing is always of good quality. The spindle 176 also permits adjustment of the axial location of the dialset mechanism 172 relative to plates 10,11. Mounting devices 176A take the form of a stepped bush 177 lying between two washers 178,179. The washer 179 acts as an abutment for a helical spring 180 engaging at the inner end in an annular groove 182 of a bush 184 received in a cup 186. The cups 186 are integral with plate members 189 by which the dialset 172 is mounted in the print head assembly with the aid of three bars 187. The

plates 189 serve to mount fixed cliche-carrying rails 190.

As viewed in Figure 6 the left-hand plate member 189 is in slidable abutment with a plate 189A having a small arcuate slot (not shown) which is aligned with a tapped bore in the member 189 to enable adjustment, by a small amount, in the relative angular relationship of the plate 189A and the member 189. This enables fine adjustment of the print position on the platen. At the right-hand (as shown) end of the spindle 176 the corresponding member 189 slidably abuts a plate 189B of generally sector shape and having an arcuate slot (not shown) by which the plate is detented to the member 189, a screw (not shown) passing through the slot and the member 189 serving to hold these parts together. The plate 189B can thus be moved arcuately to enable access to the cliche-carrying rails 190 (Fig. 1) for removal and/or replacement.

Radial displacement of the print head assembly including the dialset mechanism to take up tolerances (the amount of movement is no more than 1 mm) is accommodated by two helical compression springs 189C (only one shown) extending radially relatively to the axis of spindle 176. These springs abut the bushes 184 at their radially inner ends and extend in slots in the members 189, the radially outer ends engaging stops at ends of the slots. The springs 189C are retained in their respective slots by the plates 189A and 189B.

The plate 189A has at its periphery remote from the pivot axis an arcuate set of teeth 193 (Fig. 1). These teeth are made up from concave and convex semicircles and at the printing station engage corresponding teeth 220.

The teeth 193 and 220 serve to control the rotary motion of the print head assembly relative to the platen irrespective of presence of type in the assembly. The teeth and an arcuate surface of the plate 189B together ensure that excessive pressure cannot be applied between the type and the platen.

As illustrated in Figures 1 and 6, the cliches of the non-adjustable cliche rails 190 and the operative print facets of the adjustable dialset are arranged to be inked by an inking roller 192 mounted on a spindle 194 carried by the base plate 10 and the opposed fixed plate 11 of the applicator casing. The plate 11 has a much smaller extent than the base plate and serves mainly to cover the printhead assembly 22. The roller and spindle are preferably made in accordance with co-pending Application, Publication No. 2071811. End cheeks 19 of the roller will contact other parts (not shown) to avoid over-inking.

The print head assembly 22 also includes a control member or tail 195 which, at the end thereof adjacent to the spindle 176, has an open-ended slot 196 which co-operates, in operation, with a small roller 198 mounted on the portion 52 of the control plate 24.

The stepped bushes 177 of the spindle 176 of the print head assembly each engage one of the cams 55 or 55A which are mounted on the control plate 24. The spindle 176 also passes through slots in trunnion-like guide members 200 which are mounted at the end thereof lying beneath the print head assembly (as shown in Figure 1) in such a manner that some angular flexing movement away respectively from the plane of the base plate 10 and the plate 11 is possible. This angular flexing is apparent when comparing Figs. 2 and 2A. At the other end, each trunnion is mounted as illustrated in Figure 2 on a pin 202 surrounded by a spiral spring 204 which serves to bias the member 200 away from the plate 10 (or 11).

As will be apparent from Figure 2 and 2A, each end of the spindle 176 carries a small flanged roller 206 which engages in a track 208 formed in the base plate 10 as shown in Figure 2 (and also in the corresponding plate 11). The track 208 in the trunnion 200 and a slot 207 in the plates 10 and 11 are coincident. The trunnion 200 is secured to the plate 10 (or 11) by a screw 201 and flanged nut 203, the nut being thick enough to hold the trunnion slightly spaced from the plate 10 when fully tightened. At the end of the trunnion remote from the screw 201 a similar connection to the respective plate 10,11 is provided by a screw 202 and a nut 205 which is elongate and is surrounded by the spiral spring 204. As illustrated in Figures 2 and 2A when the spindle 176 is at the upper end of its stroke the helical spring 180 has been released and the bush 177 is thereby displaced from co-operating with track 55 to track 55A. The different cam tracks serve to move the cliches over the platen on the printing stroke to apply print pressure and on the return stroke to lift the cliches away from the platen and the inking roller.

Figures 2 and 2A illustrate the relative positions of the parts of the print head assembly respectively on completion of the printing or up-stroke and just before the latched configuration of Figure 2.

A printing platen 222 is supported between a plate (not shown) which partly duplicates the support functions of the control plate 24 and the control plate 24 itself. An end stop (not shown) is provided to prevent free motion of the print head assembly during the application motion of the control plate. The stop may be spring loaded to enable free motion of the print head for type changes and so on.

The manner of operation of the printer and applicator will now be described. The fresh label web 13 includes a backing strip or carrier of a silicone-impregnated paper carrying a

series of individual labels coated with a pressure-sensitive adhesive. The transverse edges of adjacent labels may abut one another or be spaced by a small distance, say 1mm or 1.5mm. The label web 13 is threaded around discs 53, around discs 114, around the registration device 16 with the labels facing inwardly, over the platen 222, over the dispense edge pin 20 where, in operation the individual labels are peeled off, around the roller 126 and the spent backing strip is finally engaged around the core 138 by which the label web is driven.

The fixed cliches are loaded into the type rails 190 of the print head 22 and the required adjustable facets of the dialset mechanism 172 presented ready for the desired print-out. Adjustment of the operative facets of the dialset mechanism will not be described since this is generally conventional.

In the configuration of Figure 1, with the control plate 24 shown in full lines, a label 230 been printed and dispensed and rests on a support finger 232. The control plate 24 is released by disengagement of projection 64 from stop 224 (which is pneumatically or electrically controlled), so that under gravity the control plate drops down (or is spring loaded so to do when side mounted) and the label becomes adhered to an article to be labelled. The spring 89' acts, when the machine is not able to take advantage of gravity for the apply stroke, to pull the control plate 24 towards the article and after the label has been applied, the link 76 lifts the control plate and simultaneously stretches the spring 89' ready for the next application. This initial motion is controlled by means (not shown) which sense the presence of an article and retract the stop 224 from the projection 64. The slot 46 travels downwardly along the spindle of pulley 80 which has previously become static due the delatching of the plate 85 (Fig. 3) so that the cable 98 remains slack and drive to the registration device 16 and take-up reel assembly 14 is not effected. Return motion (after an appropriate delay) from the apply stroke of the plate 24 is effected by the cylinder 70 (or motor).

Referring to Figures 3, 4 and 4A when roller assembly 79 reaches the position 79' (broken lines) at the end of the label application stroke, the plate 85 rotates clockwise about slider 90, thus bringing pulley 80 back into operation to enable drive of the feed to be reset.

During the upstroke i.e. from the position shown in Figure 1 to the chain line position 66', printing of a label on the platen takes place while the label web remains stationary relative to the platen. The print head 172 swings and hence rotary printing is effected and owing to the spring loaded mounting of the print head as a whole any slight irregularity in clearances and so on is readily accommodated without adversely affecting the print quality.

As the control plate 24 commences the upstroke, the pin 198 which has held the print head locked, moves into slot 196 thus releasing the print head and rotating it to ink the operative print facets and cliches of the print head by means of the inking roller 192. The action of the slot 196 and pin 198 is to turn the print head assembly through approximately 90° and at the end of this motion the pin and slot become disengaged. Overswing of print head is avoided by arm 195 engaging the projection 199. Cam 54A collects the print head and transfers it on to the cam track 55. Control is then effected by the cam track 55 together with rollers 206 moving along slots 207. The trunnion 200 is fixed against translatory motion relative to the respective plate 10,11, but can flex towards and away from the plate. However, the cam tracks 55 move with the control plate 24 and the action of the trunnions 200 and slots 208 is to ensure that on the upstroke, i.e. as shown part way through the stroke in Figure 2A, the print facets are controlled to contact the ink roller 192, by the upper cam surface 55 acting as the controlling factor on motion of the bushes 177. When the position is reached as shown in Figure 2 the conical spring 204 has overcome the springs 180 so that the bushes 177 are now controlled by the lower cam 55A (broken lines in Fig. 1). This cam remains in control through the downstroke so that the print facets are spaced from the platen. At the end of the downstroke, because the effect of the conical spring 204 is non-existant, the springs 180 have sufficient strength to return the bushes 177 to the cam track 55 ready for the next upstroke. Pin 199 cooperates with arm 195 to prevent over-travel of the print head assembly. As printing is about to commence the teeth 193 engage the teeth 220 with the aid of a lead-in member 221 and inter-engagement continues while printing is effected. The stop 224 is released ready for future latching of the control plate.

The overall control of the swinging motion will not affect the action of the springs 189C contained in the print head assembly so that any unevenness resulting from inaccuracies in the mechanism will be accommodated.

While this action has been taking place on the print head as a direct result of co-action with print head assembly, of parts with rigid surfaces of the control plate, the push-pull action of the cable 98 has been effective in controlling indexing of the label web with the aid of the take up reel assembly 14 and the registration device 16. As the control plate 24 moves upwardly in its arcuate path, the length of cable 98 extending from the upper anchor pulley 100 will, together with the length extending to the lower anchor pulley 100 seek to turn the core member 138 (Figure 5) in a clockwise direction, but no relative motion

may take place between the label on the platen and the platen, as the Torrington clutch 137 slips and so no motion is transmitted to the core member 138, although the latter turns with the control plate so as to avoid relative motion in relation to the registration device 16.

On the downstroke, the cable 98 will have the effect of driving the take up reel 138 in the anti-clockwise sense until a label is fully peeled by the dispense edge pin 20 and lies on the support 232 beneath the roller 63 ready for application to an article.

The manner of operation of the clutch assembly will now be described. The objectives of the assembly are to maintain tension at all times on the label web 98 irrespective of the sense of rotation of the pulley member 108 and to ensure that the winding on action is matched to the effective length of the label about to be dispensed. It will be understood that the labels themselves will have a precise length (within close tolerances) but depending upon the amount of backing strip wound on the take-up reel, the degree of angular motion will vary to a substantial extent. It follows that a constant angular rotation will not be acceptable, which would be the case if the drive motion were controlled only by the pulley member 108. Thus, when the reel of fresh labels is first used, the amount of spent backing strip wound on to the core 138 will be small so that the effective diameter is small. Correspondingly for a given length of label the angular motion will be large. When the reel 12 is approaching exhaustion, the effective diameter of the core will be large and the angular motion necessary to index one label length will be small. In order to simplify the explanation of the mode of operation, the diagrams of Figures 8A to 8G have been provided in which the angular motions of the clutch parts have been converted to relative linear motions. The parts have, of course, been given the same reference numerals as in the remaining Figures. The wind-on direction of the core roller 138 is indicated by arrow 139 in Figures 1, 8A to 8G and 9 and the unidirectional Torrington clutch mechanisms acting respectively between the pulley member 108 and the bush 134 and between the bush 148 and the spindle 136 are indicated by arrows 137,157 respectively in Figure 8. Both clutches are effective to permit relative motion between associated parts in the same sense.

The "at rest" condition is illustrated in Fig. 8A with the spring 146 in relaxed condition. Figure 8B shows the relative positions of the parts after the registration device and the take-up reel assembly have gone through one half cycle (the printing stroke), the motions being dictated only by the cable 98 as no label has been fed. Figure 8B represents the end of the print stroke, the clutch 137 having clutched for a full half cycle motion. On the feed stroke illustrated in Fig. 8C the spring 146 is loaded by the dog of bush 134 and the clutch 157 holds this with respect to spindle 136. In turn the spring 146 acts on the core 138 through the pin 152 and core 138 thus rotates an appropriate angular amount for the label effective pitch. On the next print stroke the clutch 137 by natural drag in relation to pulley 108 moves with this pulley until the pin 152 engages with the dog 149 on bush 134. The clutch 137 now slips for the remainder of the print stroke. Therefore, clutching movement of the bush 134 is equal to the total stroke movement less an angular motion, equivalent to the previous label pitch. Figs. 8E to 8G indicate the effect of different effective label pitches, respectively (3 + 1) in Figs. 8E and 8F and (3 + 1 + 2) in Fig. 8G.

In Figures 8C and 8D it is assumed that the effective length of the label is equal to three units of length in the angular sense. As for Figures 8A and 8B no motion is imparted to the core 138 on the upstroke as the Torrington clutch acting between the pulley 108 and the bush 134 slips. When driven in the opposite sense the clutch 137 drives bush 134 which, in turn drives the bush 148 through the interengaging dogs, but the core 138 remains stationary until the drive pin 152 engages the dogs, which will itself depend upon the position assumed by the core at the end of the previous cycle, while the spring 146 is thus wound up to a degree dependant upon the angular "length" of the previous label. As indicated in Figure 8D the clutch 137 "drags" the bush 134 until it engages the pin 152 and hence rotates the core.

The same process is repeated in Figures 8E and 8F, the only difference being that the spring is wound up to a greater extent because the angular extent is greater by one unit. Similar remarks apply to Figure 8G. As will be understood the effective rate of the spring 146 increases as the re-wind operation progresses.

Turning now to a detailed explanation of the manner of operation of the registration and indexing device 16 the knife edges 112 engage the gaps (however small) between individual labels and this action is further encouraged by the multiple discs 114 mounted on the spring loaded arm 120. During the upstroke the indexing device does not advance the web across the printing platen 222 because, of course, a label is being printed and any motion would result in smudging. Indexing takes place only on the downstroke after the printing, upstroke, has been completed. At all times one of the two pins 131,133 remain engaged in one of the three semi-circular recesses 113,113' and 113". As shown in Figure 1, the pin 133 is fully engaged in recess 113" and pin 131 has just become disengaged from recess 113' as dispensing of the label 230 is completed. The pin 133 being

rigid with the lever 123 which, in turn, is pivoted to the control plate prevents rotation of the disc 119 and hence the triangular member, likewise, cannot rotate and thus drive the web in the reverse sense.

Because the lever 121 is mounted for rotation with the pulley 109, anti-clockwise motion of the latter carries the lever with it and the pin 131 travels around the periphery of the disc 119 until, at the end of the upstroke the bifurcated end 124 of the lever 123 engages the pin 131 thereby displacing the pin 133 from recess 113'. As soon as the pin 131 comes opposite to recess 113 the spring 119"' pulls it into the recess and the pin 133 comes to lie on the periphery of the disc 119 ready for the next clockwise notion of the pulley 109 With the pin 131 engaged in recess 113 both the lobed member 115 and the triangular member 110 are driven clockwise thus permitting precisely controlled indexing of the web of labels At the end of this clockwise motion the bifurcated end 121" of lever 121 engages the pin 133 which has been travelling around the periphery of the disc 119 and under the action of the spring 123' the lever 121 is pivoted to disengage the pin 131 from recess 113 and to engage the pin 133 in the recess 113'. The cycle then recommences

As the control plate 24 drops or is spring-energized to apply a ready printed label the registration device remains inactive since drive to the pulley member 109 is discontinued until the upstroke of the control plate is initiated at a level corresponding to the completion of label dispensing

It will be understood that the interaction of the pins and slots ensures that at all times the triangular member 110 will be fully under control. The member 110 rotates with an indexing, uni-directional motion whereas the member 109 oscillates

The free-fall or spring controlled application stroke (below the location of Figure 1), will enable accommodation of successive articles of different heights without any special adjustment.

This application contains subject matter common with that of our co-pending application Nos. ("NOR 12 Registration" and "NOR 12 Drive").

CLAIMS

1. A take-up reel assembly comprising a core for receiving a web or other elongate flexible member which is to be indexed by a constant amount over a linear path upstream of the assembly in an associated apparatus irrespective of the amount of web wound on the core, an input drive member co-axial with the core, a first uni-directional clutch within the coreand operative to drive the core in one sense only through a bush having abutment means inwardly of the clutch and a second uni-directional clutch within the core and operativein the said one sense only and surrounded by a second bush incorporating abutment means engageable with the abutment means of the first bush, and resilient means operative in each cycle of motion of the assembly to store a quantity of energy directly dependent upon the angular motion appropriate to the amount of web wound on the core required to provide said constant indexed motion, the energy being supplied to the resilient means through the abutment means of the second bush and the core being driven to index the web by the resilient means through the first bush and abutment means.

2. An assembly according to claim 1, wherein the uni-directional clutches are Torrington clutches.

3. An assembly according to claim 1 or claim 2, wherein means are provided for adjusting the basic rate of the resilient means.

4. An assembly according to claim 1, claim 2 or claim 3, comprising a pin which serves to couple the core with the abutment means of the first bush.

5. An assembly according to any one of the preceding claims wherein the input drive member comprises a pulley with two grooves, each of which receives an elongate flexible member arranged to drive the pulley in opposite senses.

6. An assembly according to any one of the preceding claims, wherein the abutment means of each said bush is a dog extending axially from one end of the bush.

7. An assembly according to claim 6 wherein each dog is arcuate in cross-section and the resilient means is a spring having a tail disposed in the path of angular motion of the dogs.

8. An assembly according to claim 7 comprising an end cap which serves to hold the bushes and the clutches together and also has slots arranged to receive a tail of the spring at the opposite end to the first mentioned tail, the end cap being engageable in a selected one of the slots by a lever pivotal in a slot of the core, whereby the spring rate can be adjusted.

9. An assembly according to any one of the preceding claims wherein the resilient means surrounds the second bush.

10. A take-up reel assembly comprising a core for receiving a web or other elongate flexible member which is to be indexed by a constant amount over a linear path upstream of the assembly in an associated apparatus irrespective of the amount of elongate member wound on the core at any given time, oscillable input drive means co-axial with the core, a shaft coaxial with and supporting the core and the input drive means, a first one-way clutch co-operating with the input drive means, a first bush interposed between the first clutch and the shaft, the bush having a

dog extending from one end face thereof, a helical spring co-axial with the shaft, a second bush disposed inwardly of the spring and having a dog extending from the end face thereof adjacent the end face of the first bush carrying the dog, and a second one-way clutch interposed between the second bush and the shaft, the second clutch being effective to drive in the same sense as the first clutch, an end member engaged on the shaft which serves to hold the aforesaid parts together and is provided with slots one of which is selectively engaged by an end portion of the helical spring, the other end portion of the helical spring being so located that it can be engaged by the dog of the first clutch, means engageable in another of said slots to lock the end member in a desired angular location relative to the shaft whereby the rate of the spring can be adjusted and a drive pin rigid with the core and engageable with the dog of the first bush when the first clutch is being driven in the drive sense, the spring being wound during each cycle to a degree dependant upon the angular movement during that cycle to achieve the required constant linear amount indexed by the web, and during the next succeeding cycle the stored energy is released to drive the core through the pin.

11. A take-up reel assembly substantially as hereinbefore described with reference to Figs. 5 and 8 of the accompanying drawings.

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